Path.
1521
9

BRODHURST
ON
LATERAL CURVATURE
OF THE
SPINE.

Path. 1521 q

Brodhurst

C

ON

LATERAL CURVATURE

OF

THE SPINE,

ITS

PATHOLOGY AND TREATMENT.

BY

BERNARD E. BRODHURST,

MEMBER OF THE ROYAL COLLEGE OF SURGEONS; ASSISTANT-SURGEON TO THE ROYAL ORTHOPÆDIC HOSPITAL; FELLOW OF THE ROYAL MEDICAL AND CHIRURGICAL SOCIETY; ASSOCIATE OF THE ARCADIAN SOCIETY OF ROME, ETC.

G.n.1075

LONDON:

JOHN CHURCHILL, NEW BURLINGTON STREET.

MDCCCLV.

BAYERISCHE
STAATS-
BIBLIOTHEK
MUENCHEN

Dr. Samelson
from author

BAYERISCHE
STAATS-
BIBLIOTHEK
MUENCHEN

PREFACE.

In this treatise I have endeavoured to establish, mainly, three points: first, to show the causes of spinal curvature, and that the position of the primary curve differs as the cause which produced it;—secondly, that removal of the primary curve causes the spinal column to be restored to the perpendicular; but that removal of a secondary or compensating curve alone occasions increase of the primary curve; that, consequently, in the treatment of lateral curvature of the spine, the primary curve should always be acted on and removed;—thirdly, that a spinal curve cannot be removed by pressure on the convexity, but only by raising the superior extremity of the curve—by unfolding the curve.

Should I have been successful in my endea-

vour to establish these several points, my object will have been gained.

The instrument which I have described in the last chapter is novel; and the principle of action has never before been applied by means of a portable instrument to the reduction of spinal curvature. Too much praise can scarcely be awarded to Mr. Evrard for the construction of this excellent instrument.

14, Lower Brook Street, Grosvenor Square;

December, 1854.

CONTENTS.

PAGE

PREFACE V

CHAPTER I.

OF THE CAUSES OF LATERAL CURVATURE.

Classification—Debility—local debility—general debility—Muscular Hypertrophy—Muscular Atrophy—Spasmodic Action of the Muscles of the Back, Neck, and Shoulder—congenital spasm—post-natal spasm—Obliquity of the Pelvis—On the Formation of the Primary and Consecutive Curves—Rachitis—On Change in the Capacity of one or both Sides of the Thorax—Deficiency or Excess of Development of the Bodies of the Vertebræ—General Remarks on the Formation of the Curve, and on the Muscles which are implicated in producing the Curve 9-36

CHAPTER II.

OF THE SYMPTOMS OF LATERAL CURVATURE.

A Triple Curve necessary to the Restoration of the Equilibrium—Appearance presented by the Pelvis—Changes induced in the Thorax—Of Functional Derangements . 37-44

CHAPTER III.

PAGE

PATHOLOGICAL ANATOMY.

Of the Condition of the Muscles and Ligaments in Simple Scoliosis—Torsion of the Vertebræ—The Changes in the Forms of the Cartilages and the Bones—The Anterior Surface of the Thorax—The Pelvis . . 45-50

CHAPTER IV.

TREATMENT.

Of Portable Instruments for the Removal of Spinal Curvature—The Action of Instruments which press on the Convexity—Description of an Instrument for Unbending the Spinal Curve—its Mode of Action illustrated—The Efficiency of the Straight Crutch and Lateral Plate examined—Of Treatment in the Commencement of Lateral Curvature—after Rotation has taken place—Medical Treatment necessary to the Restoration of the Affected Muscles—Conclusion . . . 51-67

ERRATA.

Page 17, line 18, *for* "muscular," *read* "undue."
" " 20, *for* "found," *read* "formed."

ON

LATERAL CURVATURE OF THE SPINE.

CHAPTER I.

ETIOLOGY.

LATERAL curvature of the spine arises from various causes; as debility, muscular hypertrophy, hemiplegia, contraction of one side of the thorax, obliquity of the pelvis, &c. And the several causes may, for the sake of arrangement, be classed as follows:

1st. Debility, or muscular atony and relaxation of the spinal ligaments.

2dly. Hypertrophy, as of the muscles of an upper extremity.

3dly. Atrophy; the result of paralysis, of local inflammation, of amputation of an upper extremity, or of anchylosis of the elbow or shoulder.

4thly. Spasm of the muscles of the neck or back.

5thly. Obliquity of the pelvis, as is produced by unequal length of the legs.

6thly. Rachitis.

7thly. Altered capacity of one side of the thorax.

8thly. Deficiency or excess of development of the bodies of the vertebræ.

Of Debility.

Debility is the most frequent cause of lateral curvature of the spine.

The modes of life and dress which are usually adopted by the higher and middle classes of this country, and the sedentary occupations of many of the lower class, render the female population remarkably subject to deviation of the spinal column from the vertical.

Spinal curvature is produced both by *local* and by *general* debility.

It may be regarded as a law of the human economy that the functions of organs can alone be maintained in perfection by sufficient and adequate use; and, also, that an abnormal condition will necessarily follow abuse.

Every structure which enters into the formation of the body is amenable to these laws: bones muscles, ligaments, nerves, arteries, viscera; all agree in this respect, that disuse occasions their degeneration.

And perhaps no structure undergoes more rapid and certain change through disuse than the muscles. They become atrophic though their functions are suspended for a short time only. The ligaments also waste, and lose their elasticity, the bones their natural hardness, the calibre of the arteries is diminished, and the nerves are reduced in size. No part, indeed, of the economy is maintained in its normal condition when its functions are long suspended.

By the use of the corset, the actions of the muscles of the back are restrained. Wasting of the muscles, and relaxation of the spinal ligaments is induced—local debility, which is the commonest cause of lateral curvature of the spine.

As a bandage around a strong man's leg causes the muscles to waste, so the corset produces muscular debility. And so much is this the case, that having long been worn, the erect position can scarcely be maintained without artificial support.* And the use of the corset

* Van Swieten wrote—"Musculi longo tempore quiescentis ad

being general amongst our female population, it follows that this being a prominent cause of muscular debility, lateral curvature of the spine is also frequent. Among the lower orders this restraint is less generally and less constantly worn than by the higher grades of society; for this reason, and because exercise of the muscles of the back is essential, both for their development and perfect preservation, lateral curvature of the spine is less frequently observed in the labouring than in the superior classes of society. And for the same reason boys are seldom, if ever, affected with this form of spinal curvature. This enfeebled condition of the muscles is not incom-

paralysin disponuntur, videmus hoc evidenter in mulieribus, quæ pessimo more loricis, ex balænarum ossibus factis, corpus stringunt, die sæpe noctuque in illis totus truncus corporis sustinetur hoc lorica, quæ constrictio abdomine ossibus illi utriusque innititur, simulque axillas sustinet: hinc musculi dorsi validissimi, qui truncum corporis erectum firmant, otiantur; et cum iidem musculi decumbente in lecto homine vix agant, hinc, licet deponatur noctu lorica, tamen manent illi musculi fere otiori. Unde miseræ mulieres, quæ a prima juventute his loricis usæ fuerunt, illas postea deponere nequeunt, quia antrorsum collabantur totus truncus corporis, musculi dorsi inertibus redditis, qui in valido et exercitatio corpore spinam dorsi erectam et firmam tenere possunt, licet grave pondus humeris imponatur, uti in bajulis videmus. Vidi non sine commiseratione miseras tales fœminas, quæ nequidem somni tempore deponere audebant lorices expertæ jam sæpius quod vix se vertere in lecto possunt, multo minus corpus in lecto erigere vel erectum sustinere."

patible with a state of general good health; just as degeneration of the muscles of the leg, in long standing talipes varus, is compatible with robust health.

Spinal curvature from debility of the muscles of the back alone is scarcely known to occur without the use of the corset.*

* "As we are informed by travellers," wrote the late Mr. Shaw, "that lateral distortion of the spine is rarely seen among the women in warm climates, it may be useful to inquire into the causes of their exemption from this complaint. Since it is a common opinion that the female form may be improved by art, it might be supposed that modelling the shape is better understood, and more frequently practised in those countries than here. But the loose clothing of the women in warm climates shows that they are not indebted to stays or similar contrivances for their fine figures; indeed such restraints would be insufferable in a warm climate. Nor can we believe that their exemption from deformity is traceable to the practice of those feats of strength which are now so much in fashion here, for their indolence is proverbial. Indeed the indolent and luxurious life which they indulge in is so unlike that led by females here, that in trying to assign a reason for the difference in the tendency of the women in the two countries to become distorted, we might suppose that a life of activity was prejudicial to the figure. But this idea is at once disproved by the fine and elegant form of a healthy boy or girl brought up in the country and allowed to indulge in the active amusements natural to the youth of both sexes; who, from morning till night, are scarcely five minutes at rest, and while in bed not only lie in the most extraordinary positions, but even when sound asleep seldom remain long in the same....As long as a child continues in a state of nature, that is while it is permitted to run freely about, and before it arrives at that age when the parent is induced to pay particular attention to its figure, the form is fine and perfect; but about the age of nine or ten, what

But lateral spinal curvature is also occasioned by general debility. Thus it not unfrequently follows as a result of depressing fever, the exanthemata, &c. Long continuance in a horizontal position, and debility produced by disease, render the spinal column liable to curvature. On resuming the upright position, the muscles are inadequate to sustain the spine erect, and the column in consequence bends away from the vertical.

may often be truly called its miseries commence. When she walks, or when she sits, particular attention is paid to her manner, and the point most generally insisted on is, that she shall keep herself quite erect. For this purpose, or to give the chest a certain form, she is encased in a pair of stiff stays. Girls are thus early put under restraints not natural to their age. This in some degree renders them artificial, which is increased by the restrictions which are unavoidable in the acquirement of certain necessary accomplishments.

"If such habits be unnatural to the time of life, we cannot wonder that there should be a deviation from the natural growth of parts. It is not extraordinary that a child has its bowels disordered when its natural diet is changed; but we are apt to think it strange that the figure should not continue to grow as well *when we take great care of it* as when the child was romping, and when no attention whatever was paid to its form. To set the bowels right a variety of family recipes are often given, while the diet is neglected; but they are as ineffectual in restoring the natural tone of the digestive organs as the staymakers' contrivances are in mending the shape. In both instances we endeavour to overcome nature, or to set it right by artifices, and often by artifices that are ill calculated for the purpose."—'*Further Observations on the Lateral or Serpentine Curvature of the Spine*,' p. 29, 1825.

In its normal condition the spinal column always deviates slightly from the perpendicular. This deviation is usually found to be towards the right side, and is doubtless produced by the habitual employment of the right hand and arm in preference to the other. There may, consequently, be said to be a natural inclination of the spine towards the right side.* Thus, any cause which acts equally on the muscles of both sides, whether the corset or general debility, will increase this inclination; and, hence it is, that curvature to the right side preponderates over that to the left. So much is this the case, that curvature to the left side is the exception to the rule.

Of Hypertrophy.

Many occupations require the excessive use of one arm, and consequently occasion an increased development of the muscles of that arm and shoulder; and the spine at length yields to the superior weight and muscular strength, and is drawn to the same side, the power of the opponent muscles being insufficient to retain it in its

* Dr. Buehring affirms that, at birth, the spine is inclined towards the right side.

normal position. The right hand being that which is usually employed most actively in laborious pursuits, causes the convexity of the spinal curve to be formed towards the right side. But if the left hand and arm have been used rather than the right, (and this is frequently the case with nurses, who carry the infant on the left arm), the convexity will be formed towards the left side.

Compositors, needlewomen, embroiderers, tailors, are remarkably subject to spinal curvature from this cause.

Of Atrophy.

Atrophy of the muscles of one side of the thorax, from whatever cause, induces lateral curvature of the spine. Thus, when, through anchylosis of the shoulder, the muscles of the opposite side are brought more actively into use than formerly, the normal antagonism being no longer observed, the spinal column inclines towards that side on which the muscles are the most active. And the same occurs after amputation. Nor is it alone that the weight of the upper extremities is thus rendered unequal, for though it were again equalised, the same would

occur. Continued action of one set of muscles overcomes the effect of inaction of their opponents, to produce spinal curvature; as, in the former instance, hypertrophy was shown to overcome normal action: and in the same manner, paralysis of one side, or of a single muscle, will give rise to spinal curvature. The balance of power being destroyed, the right line of the column can no longer be maintained.

Inflammation of a muscle, or of its sheath may, also, give rise to spinal curvature.

As will be explained, the spinal curve differs as the cause which occasioned it. When the muscles which hold the spine erect are on one side paralysed, either wholly or partially, the curve is not compensated, but is a single curve from the pelvis upwards. But when the muscles of the upper extremity have given rise, by muscular action, to a curve in the upper or middle dorsal region, a compensating curve will be found below, in the lower dorsal and lumbar regions, to restore the equilibrium of the body; and this principle of compensation is always observed when a short curve is primarily formed; or two short compensating curves are formed subsequently to the primary curve.

For the treatment of lateral curvature of the

spine, it is of the utmost importance to determine which is the primary curve; for, whilst the primary curve is increased by acting mechanically on a secondary curve, reduction of the primary curve removes, at the same time, the compensating or secondary curves, and restores the column to the perpendicular.

Of Spasm of the Muscles of the Back, Neck, and Shoulder.

Spasmodic action of the muscles of the back occurs rarely as a congenital affection; sometimes without other complication, or, again, concurrently with distortion of the hands, feet, &c. It is produced by morbid changes in the nervous centres, such as are implied by absolute destruction or softening of the brain or spinal cord, or which result from inflammation or irritation.

With partial or complete destruction of the brain and spinal cord, the distortions are occasionally monstrous. Not only do we find talipes in every variety, torticollis, &c., but unnatural distortions, as the leg bent forwards upon the thigh, through retraction of the quadriceps extensor; the forearm backwards upon the arm, through retraction of the triceps extensor cubiti,

&c.; and dislocations, also, as of the head of the femur, &c.; and occasionally there is combined with retraction of other muscles, retraction of those of the back, or of the back and neck, which produce lordosis or scoliosis.

These congenital curvatures, especially lateral curvatures, are sometimes excessive, reducing the trunk one third or more in its height.

After birth, also, the same causes exist, and to a greater extent than before birth. Dentition is amongst the most frequent causes of spasmodic affections; and the exanthemata are often followed by convulsive disorders which terminate in muscular retraction. Thus spasmodic retraction of the muscles of one side of the back, and of the hand and foot of the same side, is no uncommon result of dentition; and scarcely less frequently does it occur as a sequence of exanthematous eruptions.

The extensors of the foot, the pronators of the hand, and the flexors of the fingers, are the muscles of the extremities which are in these cases usually affected. After long duration of spasmodic action, there is frequently combined paralysis, partial or complete, of one or more muscles, or even from the commencement.

As a result of cerebral or spinal affection it is

rare that the muscles of the back are alone affected. Generally other muscles, as of the extremities, are at the same time affected.

There is a form of muscular retraction which I must here allude to, which differs from the last mentioned, however, in being occasioned by local irritation. After rotation of the bodies of the vertebræ upon their axes has commenced, an abnormal action of retraction is frequently observed in the muscles on the convexity at the lower extremity of the curve; and this retraction would appear to be induced by the irritation occasioned by the increased prominence of the processes of the vertebræ on the convexity of the spinal curve. When bands of muscle become retracted at the lower horn of the curve, as now indicated, not only do they tend to increase a spinal curve, but they form an almost insuperable barrier to the successful application of mechanical means.

Of Obliquity of the Pelvis as a cause of Spinal Curvature.

Obliquity of the pelvis, induced by unequal length of the legs, is a frequent cause of spinal curvature. Rachitic curves of the tibia and

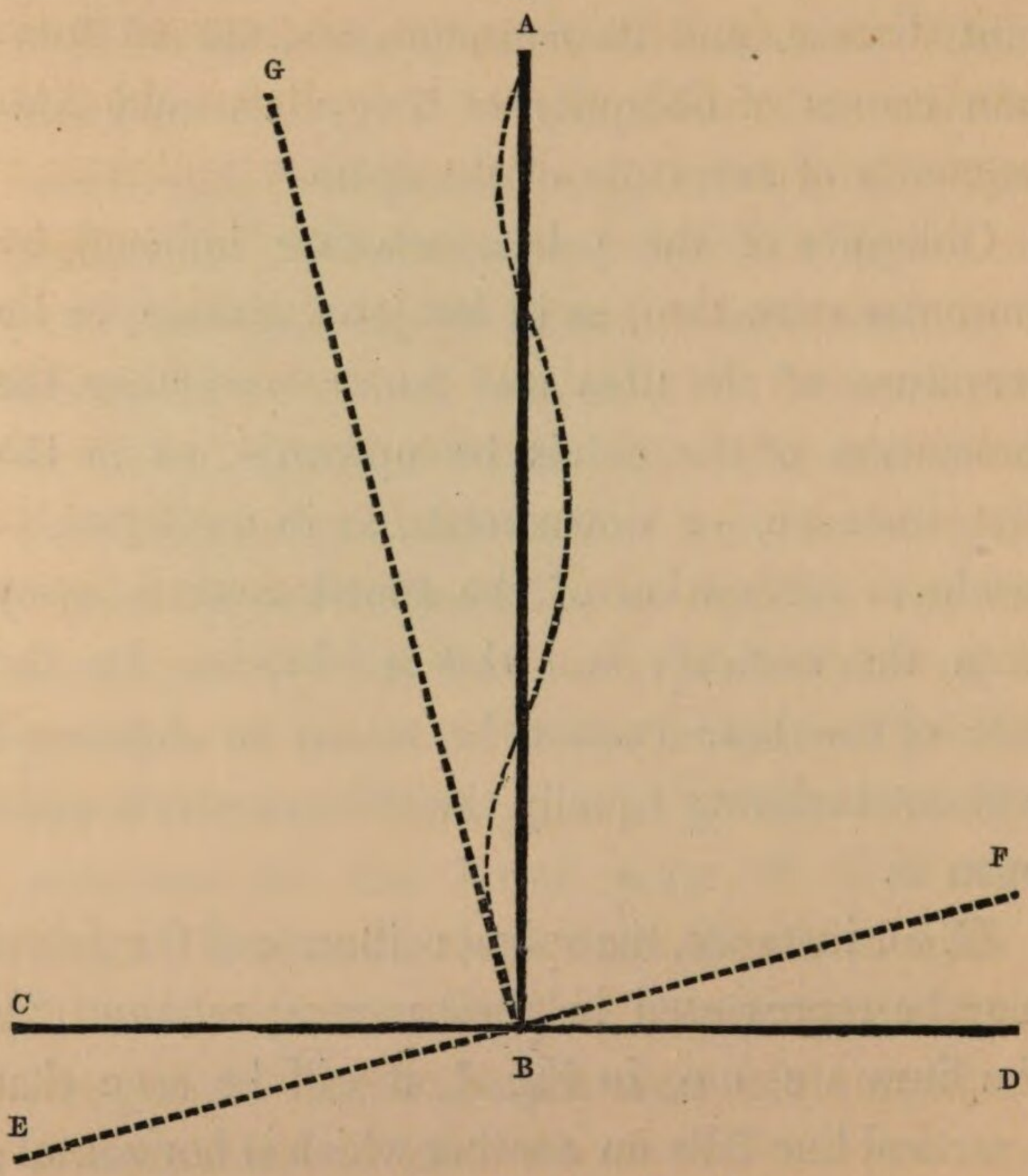
femur; fracture of the leg or thigh; dislocation of the femur; extension of the internal or ex-external lateral ligaments of the knee-joint; hip-joint disease, and its consequences, are all common causes of obliquity of the pelvis, and consequently of curvature of the spine.

Obliquity of the pelvis, whether induced by muscular retraction, as in hip-joint disease, or by curvature of the tibia and femur,—whether the inclination of the pelvis be upwards, as in the first instance, or downwards, as in the latter,—produces inclination of the spinal column away from the vertical; and this is obvious, for the side of the base cannot be raised or depressed without inclining equally the column which rests upon it.

If, for instance, the spinal column and the pelvis may be represented in their normal relations by the lines A B, C D, in Fig. 1, it will be seen that a vertical line falls on another which is horizontal; and, if C D be changed to E F, the direction of the spinal column will be from A B to G B, that a right angle may still be retained between the column and its base. But the equilibrium of the body must be maintained; and since that could only be effected in its new position, G B, E F, by great muscular expenditure, the spinal column,

A B, accommodates itself, by a series of curves, to the oblique position of the pelvis, E F. Thus, to

Fig. 1.



regain the perpendicular, the inclined column is thrown towards its original direction, to form the *primary* curve in the lumbar and lower dorsal regions; and to restore the equilibrium, a *second* or *compensating* curve is formed, which occupies the middle and upper dorsal, and perhaps also the lower cervical vertebræ; and this compensa-

tion is completed by a third curve, in the sacral region, or even by other two, in the coccygeal and cervical regions.

For the sake of explanation, the curves in the accompanying diagram have been drawn about the perpendicular. But, although the equilibrium of the body is restored by means of the compensating curves, the perpendicular direction of the trunk is only regained after excessive distortion has been produced. Ordinarily, when spinal curvature has been occasioned by obliquity of the pelvis, the line of deviation, as marked in fig. 4, is observed.

Of Rachitis.

Rachitis is essentially a disease of infancy, seldom occurring after the twelfth year, and yet more rarely as a congenital affection. Occasionally, however, rachitic curves of the long bones and of the spinal column are found at birth.

Rachitis is usually developed during the second year, and after the child has been weaned. So much is this the case, that two thirds of the whole number of cases of this disease may be said to be developed during the second year of life.

The female appears to be more liable to this affection than the male sex. Thus, of 400 cases which I have noted at the Orthopædic Hospital, 280 have been females and 120 males.

When the disease attacks during the earliest years of life, distortion is perhaps never so extreme as when it commences between the ninth or tenth year and puberty. The most severe instances of distortion which I have witnessed as a consequence of this affection, have first been noticed between the ninth and twelfth years.

Insufficient and improper nourishment, exposure to cold and damp, and ill-ventilated and badly drained habitations, are prominent causes of this affection.

In rachitis, changes, more or less, take place in the entire skeleton; but these are especially perceptible in the long bones, in their proportions and in their direction. The long bones are diminished in length, are curved with a single or a double curve, and often are twisted on their axes. The entire bone is swollen (especially the epiphyses), infiltrated, and softened, and its apophyses are rendered unusually prominent. The skeleton loses height, and development is arrested.

The bones in this disease exhibit great de-

ficiency in the earthy salts; and, on the other hand, contain cartilage and fat in excess.

After a time, swelling of the bones subsides; the new matter, which was poured out into their interstices, and between the periosteum and the bone, becomes organized, and the bone increases in weight and solidity; or the sanguineous liquor which percolated along the bones and between the lamellæ becomes absorbed, leaving the bones brittle and of shell-like fracture.

And the bodies of the vertebræ partake of this affection. At first swollen and infiltrated, they become shrunken and irregular on their surfaces. The first period, or that of incubation, as it has been termed, is followed by deformity; when the softened bones yield to the superincumbent weight. The bodies of the vertebræ swelling unequally, and afterwards shrinking unequally, the pressure of the superincumbent weight adds to the existing irregularity of surface. Curvature has already commenced, and proceeds rapidly. The column becomes bent upon itself and twisted on its axis, to produce such distortion as is witnessed in no other form of disease.

And superadded to distortion of the spine, there is, what is pathognomonic of rachitis, distortion of the pelvis and of the long bones. The

long bones usually first become affected, afterwards the pelvis, and lastly, the spine. But the order is occasionally inverted, and the spine first becomes affected. In no other form of spinal affection does the pelvis become thus distorted; and in the treatment of these affections this point should ever be borne in mind. Rachitic distortions of the pelvis are irremediable. To give an idea of the distortion which may be produced, I will mention the case of Isabel Redman, on whom the Cæsarian section was performed, by Dr. Hull. So much was the pelvis distorted, that a ball, one inch in diameter, could not pass the brim.

The capacity of either side of the Thorax being increased or diminished, Lateral Curvature of the Spine will result.

Contraction of the thorax takes place as a consequence of pleuropneumonia and empyema. When the effused fluid begins to be absorbed, adventitious membranes may bind down the lung and prevent its expansion. And if, as the fluid is removed, the lung cannot expand to support the ribs, the ribs must sink to the lung, forced by atmospheric pressure. And the action of one

lung being diminished, that of the other is necessarily increased, so that the difference between the two sides is yet augmented. Not only is the lung compressed, and the diseased side narrower than in its normal state, but amplification of the sound lung and enlargement of its containing cavity take place. Either diminution or enlargement of one side of the thorax would be sufficient to occasion deviation of the spinal column from the vertical: how much more so both causes being combined!

An interesting example of distortion of the thorax, resulting from empyema, and the treatment which was adopted for its removal, is mentioned in his work, by Dr. Little.*

On the diseased side of the thorax, the intercostal spaces may become obliterated, and the ribs encroach and lie one upon another: the shoulder of the same side is depressed, while that of the other side is raised. The concavity of the spinal curve is towards the diseased side.

* 'On the Deformities of the Human Frame,' p. 362, 1853.

Of Deficient Development, and Excess of Development, of the Bodies of the Vertebræ.

These are, I believe, very rare affections. They are congenital, and necessarily irremediable.

Occasional deficiency of the lateral half of a vertebra occurs; or, on the other hand, one or more half bodies may be in excess, or the lateral halves of the spinal column may be unequally developed.

In the Imperial Pathological Museum, at Vienna, is a very remarkable instance of this kind of deformity of the spinal column, of which the following description is given by Professor Rokitansky:

"The sacrum and coccyx are united into one bone, on the right side of which there are four sacral foramina, and five on the left; for the first sacral vertebra is higher on the left side than on the right, and, as is evident, from its left spinous and articular processes being double, it consists on that side of two lateral halves of vertebræ fused together. The fifth lumbar is developed on the right side to a sacral vertebra, and thus the height of the left half of the sacrum is level with the right.

"The first lumbar vertebra, in the concavity of

the lumbar curve on the left side, appears very depressed, being not more than eight lines in height, and is concave from above downwards; while on the right side it is convex, and more than two inches high, and has a horizontal groove filled with an ossified intervertebral body, which indicates that it is double on that side. On the left side there is but one half-arch, on the right there are two; there is also a small supernumerary intervertebral foramen, on the same side (the right), and a half-spinous process which has no fellow.

"This odd half-spinous process alters the position of the bodies of the vertebræ, and more particularly of their spinous processes above and below, in such a manner that the laminæ, more or less displaced and overlapping, terminate in a row of unsymmetrical spines. Inferiorly, the derangement stops at the second lumbar vertebra, but above it reaches to the eighth dorsal; the right half spines of the first and second lumbar vertebræ lie beneath those of the left side; but the right half spines of the twelfth, eleventh, tenth, ninth, and eighth dorsal, are placed above those of the left side: hence, they either appear unsymmetrical, or here and there one of the right

half spines comes in contact with the left one of the vertebra next above.

"The left half of the seventh dorsal vertebra, on the convex side of the inferior dorsal curve, is very high; it is pretty distinctly marked with a horizontal fissure in the same way as the first lumbar vertebra, and has two half-arches instead of one, just as the first lumbar has on its right side. The lower one, which is the thicker, unites with the single arch that exists on the right side, and both together form a complete spinous process: the upper one terminates in an odd spine. There is an intervertebral foramen between the double arches, which is rather smaller than the foramina adjoining it above and below. The sixth dorsal vertebra has an apparently odd arch on the right side, which is adapted to the supernumerary half spine of the seventh dorsal vertebra, while the left arch, as will presently appear, is shrunken and combined with the corresponding arch of the fifth.

"Between the sixth and fifth dorsal vertebræ, on the right side (at the convexity of the upper dorsal curve), another, a fourth half vertebra, is intercalated, which has a half-arch on the right side. Its spinous process unites with the com-

bined left half spines of the fifth and sixth dorsal vertebræ.

"The fifth dorsal has an arch, the left half of which (at the convexity of the upper dorsal curve) is increased in breadth, by union with the left half-arch of the sixth dorsal. It has but one transverse process, and it unites with the half-arch of the intercalated half vertebra to form one very broad, flat, spinous process; while it forms another, and more slender one, with the corresponding right half-arch of the fifth.

"The half-arches of the fourth dorsal vertebra lie one over the other, the left uniting with the slender spinous process of the fifth (fifth and sixth), whilst the right terminates in a half spine.

"The third dorsal is tolerably well formed; but the right half-arches of the second and first coalesce, and their single spinous process joins with that of the left half-arch of the second, while the other half of the first terminates again in an odd spine.

"According to this, therefore, there are in the dorsal, lumbar, and sacral parts of the column, four half vertebræ, with their half-arches and processes, too many. They are so placed on the two sides as fully to compensate one another; for upon the duplication of the left half of the first

sacral vertebra, there follows duplication of the right half of the first lumbar: and then, as the left half of the seventh dorsal is double, there is half a vertebra interposed on the right side, between the sixth and fifth dorsal. And with regard to the arches,—the half-arches of the sixth and fifth dorsal coalesce on the left side, and those of the second and first dorsal on the right.

"Lastly, as has been already pointed out, there result from the position of the abnormal half vertebræ the following curvatures of the whole column:

"*α*. Curvature of the sacrum, with the convexity towards the left, in consequence of duplication of the left half of the first sacral vertebra: the development of the fifth lumbar vertebra to a half right sacral compensates this curve.

"*β*. Slight curvature in the lumbar and lower dorsal regions, in consequence of duplication of the right half of the first lumbar vertebra: the convexity at this part is directed towards the right.

"*γ*. Considerable curvature in the middle dorsal region, produced by the left half of the seventh dorsal vertebra being double: here the convexity is towards the left.

"δ. Considerable curvature in the upper dorsal region, which is caused by the half vertebra interposed between the sixth and fifth dorsal vertebræ: the convexity here faces the right. The last two form a very compressed S curvature; and the vertebræ are twisted upon their axes and project backwards (kyphosis)."*

To this spine are attached fourteen ribs on each side.

Thus, it is shown, that there are many causes of spinal curvature.

Each cause of lateral curvature offers peculiarities in the nature and formation of the curve by which it may be readily distinguished. There are also phenomena common to every variety of lateral curvature.

When the spinal column inclines away from the vertical, from whatever cause, extraordinary muscular action is exerted to restore the equilibrium of the body. This is common to every form of lateral curvature of the spine, whether caused by debility, paralysis, increased muscular action, obliquity of the pelvis, distortion of the thorax, rachitic disease of the vertebræ, or through error of development. And the mode in which

* 'A Manual of Pathological Anatomy,' Sydenham Society's Ed., vol. iii, p. 228, 1850.

equilibrium is restored, constitutes one of the peculiarities incidental to each variety of curvature.

The muscles of the shoulder, for instance, becoming largely developed, or undergoing increase beyond those of the other shoulder, raise the scapula above its normal position; and, secondly, draw the spine away from the perpendicular. The deltoid, the supra-spinatus, and the infra-spinatus are those which commence the action; and the trapezius, and the rhomboidei draw the spine out of the perpendicular. The vertebræ which enter into this curve will probably be six or eight superior dorsal, and one or two inferior cervical.

Again, should the labour be overhand work, the following muscles will be those which have mainly contributed to form the curve; namely, trapezius, rhomboidei, splenii, serratus posticus superior, cervicalis ascendens, transversalis colli, trachelo-mastoideus, sterno-cleido-mastoideus, complexus, and levator anguli scapulæ. And these, acting on the inferior cervical and superior dorsal vertebræ, produce a curve, formed of three or four lower cervical and an equal number of dorsal vertebræ.

Or, should the curve be formed by carrying a

heavy weight on one arm, as a basket, a child, &c., the curve will probably be formed in the middle dorsal region; and the muscles principally engaged will be trapezius, and latissimus dorsi.

When, through debility of the muscles of the back, the spinal column is allowed to deviate from the perpendicular, the more powerful muscles contract to restore the equilibrium. These are usually the muscles on the right side of the column. And in effecting this purpose, a dorsal curve is formed with its convexity towards the most powerful muscles.

When a curve has been formed in the dorsal region, if there be not paralysis on the side of the concavity, a compensating curve is necessarily formed beneath it; but when paralysis of one side exists, the spine is bent in one continuous curve from below upwards, by the latissimus dorsi, trapezius, and erector spinæ muscles, with the convexity towards the same side.

The compensating curves are always formed above and below the primary curve. When, for instance, obliquity of the pelvis has given rise to a lumbar curve, it is compensated by a dorsal and a sacral curve. Or, when a dorsal is the primary curve, it is compensated by a cervical, and a lumbar curve. Equilibrium can never be

restored by a sigmoid curve; for the compensating curve is always a more open curve than the primary curve. And, if severe, the primary curve may require four compensating curves to restore the equilibrium. A lumbar curve, for instance, may occasion sacral and dorsal compensating curves; and finally, cervical and coccygeal curves. Thus, a spinal curve can only be single for a short period after its formation, or when it has been occasioned by paralysis. It can never remain a sigmoid curve; but a sigmoid curve having been formed, the spine is always shaped into a triple or a quintuple curve.

CHAPTER II.

SEMEIOLOGY.

LATERAL curvature of the spine exists, in its earliest stage, in the erect position of the body only, and ceases in the horizontal posture. This is equally the case whether it is caused by deficiency or excess of muscular action.

After some duration, however, curvature becomes confirmed, and the perpendicular direction of the column can alone be restored by support and properly-adjusted force—by raising, namely, the depressed shoulder, and supporting the convexity of the curve. In some instances, the perpendicular is restored by slight support only; in others long-continued mechanical force is required. In the first class of cases the muscles in the concavity require to be assisted to hold the spine erect; in the second the shortening of the ligaments and muscular retraction have to be overcome.

When a single curve alone exists, and before a

secondary curve has been produced, the trunk presents a more distorted appearance than when equilibrium has been in part restored by the formation of a sigmoid curve. When the curve is single, one shoulder is depressed, whilst the other is raised; but a compensating curve being formed, the shoulders are again brought nearer to the same level. Thus the difference in the height of the shoulders is lessened by the compensating curve. It has already been shown, however, that a consecutive curve always represents the segment of a larger circle than the primary curve; consequently, equilibrium can never be restored by means of a sigmoid curve; and the difference in the height of the shoulders will be, in an ordinary instance of spinal curvature, and when muscular development is not excessive, equal to that which exists between the segments of the primary and the consecutive curves. That equilibrium may be restored, a triple or a quintuple curve is therefore necessary.

Thus, a dorsal curve being formed, two consecutive or reverse curves will probably compensate it—one in the lumbar region, the other in the cervical. This lower compensating curve gives rise to farther distortion—namely, of the pelvis.

Obliquity of the pelvis necessarily induces a lumbar curve; and a lumbar curve as surely, though more slowly, gives rise to obliquity of the pelvis.

The primary curve in the dorsal region having its convexity to the right side, is compensated by a lumbar and a cervical curve to the left. And, that the normal relation between the lumbar vertebræ and the pelvis may be retained, the pelvis must be tilted, the right ilium being raised, while the left is depressed. The right trochanter is thus rendered abnormally prominent; and whatever tends to increase the lumbar curve, increases also obliquity of the pelvis, and, consequently, projection of the trochanter. Abnormal projection of the trochanter, without affection of the hip-joint, is symptomatic of obliquity of the pelvis.

The muscles in the concavity of the spinal curve are flaccid, and those on the convexity are tense: the latter disposition is particularly to be observed towards the lower horn of the curve. These muscles are the chief agents in increasing distortion after it has commenced, by adding rotation of the vertebræ to simple lateral curvature.

Consequent on distortion of the spine, the ribs

become twisted and deformed, and the entire thorax undergoes marked disfigurement. The scapula which corresponds to the convexity of the thoracic curve is, at first, raised with the entire shoulder; its inferior angle becomes unnaturally prominent, and is directed outwards, and its superior border is carried forwards and inwards. The inferior angle may escape from and ride over the edge of the latissimus dorsi muscle.

Through rotation of the vertebræ, the angles of the ribs on the side of the convexity are rendered abnormally prominent; and this portion of the rib represents the segment of a much smaller circle than in the normal condition, through rotation of the vertebræ, and through flattening of the bodies of the ribs: and as distortion of the ribs increases, so the scapula is displaced and thrown outwards.

On the side of the concavity, the ribs are flattened and depressed, and the scapula sinks together with them, so that increased fulness on one side, and depression on the other, together produce great disfigurement. The ribs on both sides of the thorax are flattened, but especially on the convexity; so that, the bodies of the vertebræ being rotated into the convexity, and the ribs on the side of the convexity being flattened, the

thoracic space for the expansion of the lung is less on this side than on that of the concavity.

The anterior surface of the thorax, also, presents considerable alteration in form. On the side of the convexity the ribs are flattened; the shoulder is raised and carried forward; the nipple of the breast presents outwards, and the gland itself becomes atrophic. Sometimes the nipple of the breast is found lower, and sometimes rather higher than on the other side; but this varies as the dorsal curve varies. On the side of the concavity the ribs are, anteriorly, more prominent than usual, so that the greatest diameter of the thorax is now oblique from behind forwards. Frequently, it is this circumstance of diminution in the size of the breast which first attracts a parent's attention.

Pain is an uncertain symptom of lateral curvature of the spine. In young, chlorotic females, in whom spinal curvature has arisen through debility, pain in the left side is frequently felt; but even though the convexity of the curve be to the right side, pain is seldom felt on the right side. When curvature has been induced by increased muscular action, pain is generally present

on the side of the convexity, sometimes beneath the scapula, sometimes towards the top of the shoulder, sometimes radiating from the central vertebra of the curve, but usually below this point, and is referred to the ribs and intercostal spaces. In this last-mentioned class of cases, pain is probably produced by the extension and resistance of the inter-vertebral and costo-vertebral ligaments, by the changes that are taking place in the bodies of the vertebræ and in the inter-vertebral substances, and by the irregular tension of the inter-costal muscles. But there are, also, numberless cases which have passed through every phase of distortion, in which pain has never been felt. This is especially the case with the rachitic curve.

Pain which is occasioned by extension of ligaments, and irregular tension of muscles, is relieved by supporting the trunk. Frequently the effect of a well-adjusted spinal instrument is almost magical, so immediate is the relief afforded.

Functional derangements in the early stages of lateral curvature may generally be referred to other causes than the curvature itself, and may frequently be traced rather to the cause of distor-

tion than to the distortion itself; they are as frequently antecedent to, as concomitant with, deviation of the spinal column from the vertical. But, when distortion has advanced to a sigmoid, or a triple curve, the thorax may have become so much distorted that respiration may be impeded; the action of the heart may be rendered irregular, sometimes slow, sometimes tumultuous; and the gastric functions may also become disordered. The changes in the thorax are effected so gradually, however, that for the most part the contained viscera accommodate themselves to the diminished space, and their functions are but slightly disturbed; yet unusual excitement will generally produce some discomfort.

The uterine functions are more frequently interfered with, and rendered irregular and feeble, than those of either the heart or the lungs. Dysmenorrhœa and amenorrhœa are frequent accompaniments of lumbar curvature. Gastralgia and obstinate constipation are also frequently found to accompany these curvatures.

If the disease advance unchecked, one cause will react upon another to produce excessive derangement of the economy. The lungs and heart perform inadequately their functions; the phy-

sical strength is impaired; the muscular system wastes; the vital functions, whether of nutrition, generation, or relation, are altered and enfeebled; and preeminently, digestion, assimilation, circulation, and generation are affected.

CHAPTER III.

PATHOLOGICAL ANATOMY.

Scoliosis may be divided, according to its degree, into spinal curvature with, and without, rotation of the vertebræ.

Few words only are required to explain the changes which occur in simple scoliosis.

Before rotation of the vertebræ is superadded to simple scoliosis, the affection is rather of the muscles and ligaments than of the bones and cartilages. The muscles on the convexity become tense, and on the side of the concavity they are relaxed. The ligaments on the convexity are elongated, and in the concavity they are shortened; and consequently the superincumbent pressure is greater on the side of the concavity.

The weight being thus borne unequally on the bodies of vertebræ, the intervertebral substances become compressed in the concavity; they lose something of their height, and may at length be entirely removed.

But, as soon as unequal pressure has produced inequality of surface, rotation of the vertebræ commences. Hitherto, distortion has been comparatively slight and unimportant; but as soon as rotation of the vertebræ on their axes has been added to simple scoliosis, most important changes take place, which I will proceed to describe.

Torsion or rotation of the vertebræ on their axes having commenced, distortion proceeds more rapidly than heretofore. The intervertebral substances in the concavity are reduced in thickness, while on the side of the convexity they retain their natural height, or even, in some cases, expand beyond their normal height. Tension of the muscles on the side of the convexity is at the same time increased. And these acting on the vertebræ, cause them to be twisted,—the spinous processes towards the concavity, and the thickest portion of the bodies of the vertebræ into the convexity of the curve: and, from continued pressure, the bodies of the vertebræ themselves undergo partial absorption, and losing something of their natural form, become wedge-shaped; especially three or four which are placed towards the centre of the curve, are the most altered in shape: but that vertebra which occupies the centre of the curve—which is as the key-stone of

an arch—is the most wasted and the most rotated. Thus, the bodies of the vertebræ on the side of the concavity may lose a portion of their height; but the middle vertebra of the curve may be reduced to one third, or even lose more of its height. These observations apply with more force to primary than to secondary curves; yet wasting and rotation take place in a secondary as in a primary curve, though to a less extent. When the lumbar is, however, the primary curve, distortion, when of long standing, is usually greater in the dorsal than in the lumbar curve.

The spinous processes of the vertebræ present a spiral arrangement from one curve to that next above it; no longer piled one directly above another, but varying as the bodies of the vertebræ are wasted and rotated. And the spinous process of the central vertebra of the curve is always the deepest in the row of spines.

In consequence of this obliquity of the vertebræ, through the wedge-shape and torsion of the bodies, the transverse processes and the ribs on the side of the convexity at the superior portion of the curve, are raised and carried backwards; but those which correspond to the lower portion of the curve are depressed and carried

backwards; the intercostal spaces are widened; the ribs are flattened; the scapula is raised and rendered prominent, and its inferior angle is thrown outwards. Whilst on the side of the concavity, the transverse processes of the vertebræ which enter into the lower portion of the curve, are raised to a plane above those on the convexity; but in the upper portion of the curve they occupy a plane below those on the side of the convexity. And as the transverse processes on the side of the convexity are rotated backwards, to be rendered abnormally prominent, it follows that those on the inside of the curve must be rotated forwards. The ribs are flattened and depressed, and the scapula sinks together with them. The intercostal spaces may be obliterated entirely, or in part, and the ribs may lie one over another. Pressure of the ribs upon the transverse processes, and of the articular processes one upon another, occasions partial absorption of these processes; and they become attenuated and lengthened in form: and the ribs themselves, after a continued period of distortion become atrophic.

On both sides of the thorax the ribs are brought into closer proximity to the bodies of the vertebræ, being flattened; and their angles are

rendered unusually prominent. On the side of the convexity the ribs are frequently so closely approximated to the bodies of the vertebræ as to reduce materially the capacity of the thorax and the space for the expansion of the lung.

On its anterior surface, also, the thorax shows considerable change from its normal condition. On the side corresponding to the convexity of the thoracic curve, the superior ribs are flattened, the breast becomes atrophic, the nipple presents more laterally than usual, sometimes lower than on the other side, and sometimes rather higher, being influenced by the position and the amount of the dorsal curve. Notwithstanding the apparent increase of size on the side of the convexity, and diminution on the side of the concavity, the thoracic space is generally greater on the side of the concavity than on that of the convexity; and the greatest diameter of the chest is now found to be in an oblique direction from behind forwards, the ribs having an inclination backwards on the side of the convexity, but forwards on the side of the concavity.

The intervertebral substances may be entirely removed, and then anchylosis takes place between the adjacent bodies of the vertebræ; between the articular processes; between the ribs and the

transverse processes; and, perhaps, between the ribs themselves on the side of the concavity.

The pelvis is always rendered oblique by a lumbar curve, and the sacrum, in spinal curvature of long standing, acquires a curved direction opposed to the lumbar curve, and the coccyx a curve the reverse of the sacral curve. But beyond these distortions, the pelvis does not ordinarily undergo change of form, (except in rachitic disease of the bones), but alone in direction. The brim is neither narrowed, nor is the outlet altered in form; yet in very severe and long standing spinal distortion, the ischium and pubis, on the side corresponding to the convexity of the lumbar curve, may be slightly flattened to encroach on the pelvic space, the weight of the trunk being unequally transmitted to the lower extremities.

CHAPTER IV.

THERAPEUTICS.

THE treatment of lateral curvature of the spine may be resolved into mechanical, and medical. First, then, of mechanical treatment.

It will scarcely be necessary to compare the different modes of treatment in vogue for lateral curvature, as regards the prone position and the portable instrument; the latter presenting so many advantages which the former has not, that it is now usually employed in the treatment of lateral curvature. Passing over, then, the different forms of couches which have been from time to time employed in the treatment of lateral curvature of the spine, I will briefly examine some of the portable instruments.

There are many forms of portable instruments, though all are made on one of two principles of action. Thus, one kind acts on the convexity of the curve; the other on the superior extremity of

the primary curve. Of the former, is the instrument invented by Delpech, and used by Stromeyer, and at present by Mr. Tamplin; and also that of Tavernier, and its modification known as Mr. Lonsdale's. The former consists essentially of a metal plate, which presses on the convexity, and laterally, on the ribs; the latter, of a webbing band, which presses posteriorly and laterally. Many others, somewhat differing in form, act in the same manner.

The other kind of portable instrument is constructed to unbend the curve, by raising the superior extremity of the curve. This instrument I will describe at length. It was suggested by observations made on M. Guérin's spinal chair, and Mr. Lonsdale's spinal couch; and it was constructed by an able mechanist, Mr. Evrard.

It was shown in a former chapter, that lateral curvature of the spine induces a wedge form of the bodies, or of some of the bodies, of the vertebræ which enter into the curve; that the thinner edges of these wedges are formed in the concavity, and the thicker portions in the convexity; that the ribs are flattened laterally, and approximated to the bodies of the vertebræ: that

the thoracic space, especially on the side of the convexity, is thus materially diminished.

And whatever increases these conditions, necessarily increases deformity.

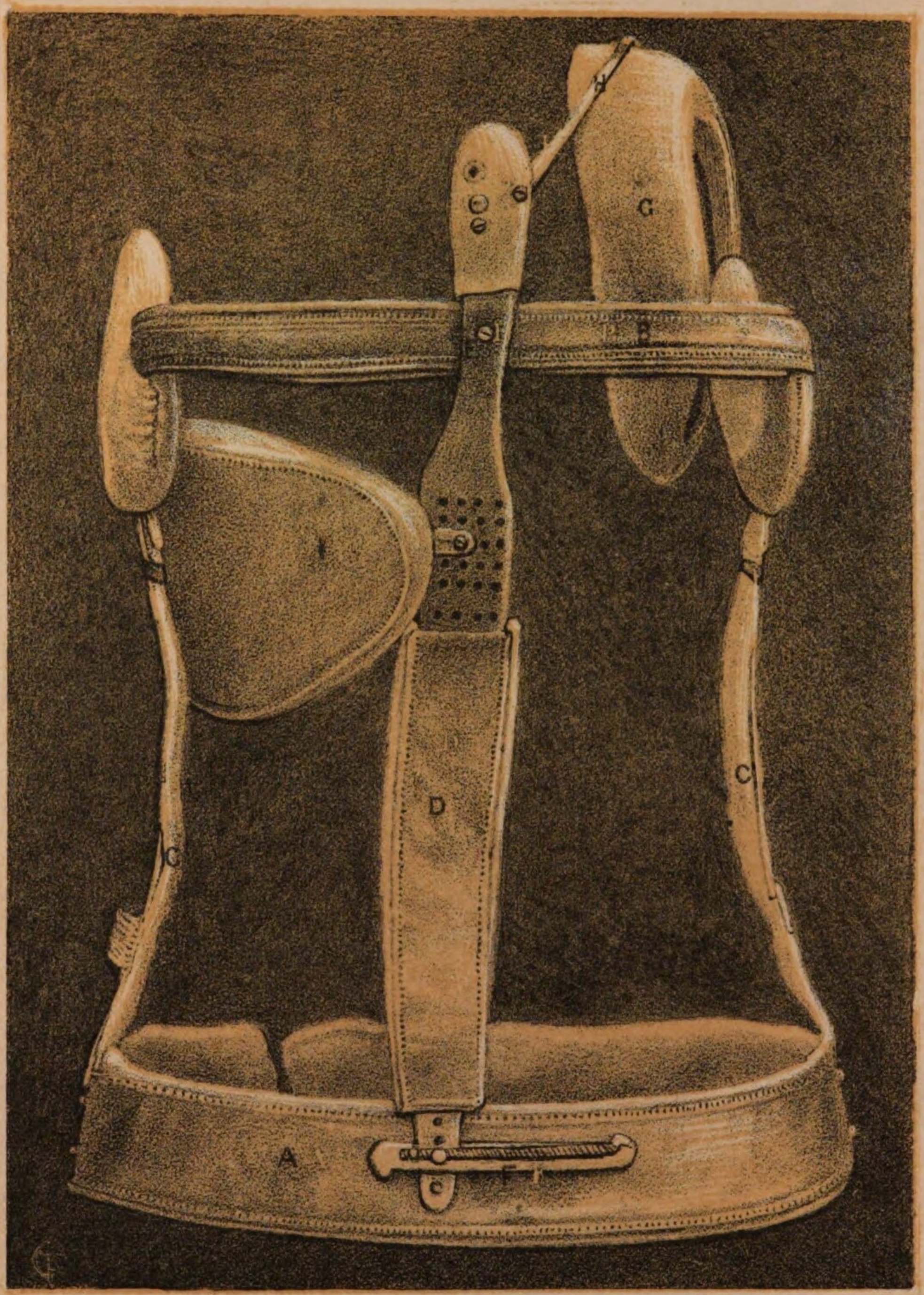
Every instrument which acts on the spine by pressure laterally on the ribs, must, after rotation has taken place, increase the flattening of the ribs; and must, also, increase, through pressure on the convexity, the wedge-shape of the bodies of the vertebræ. Much might be said on this subject; I will, however, only further reproduce a few lines from the late Mr. Shaw's work. "There can be little doubt," wrote Mr. Shaw, "that a lateral pressure made upon the ribs, when the spine is slightly bent, will tend to throw the sternum forwards, and thus to give the chest not only the form resembling that of a bird, but even of a fish." And again, "It is easy to demonstrate that the application of an instrument with this intent, (lateral pressure,) not only diminishes the area of the chest, but increases the distortion; for the shoulder is pressed against the flat part of the ribs; and consequently, the unnatural angle, which even in cases of slight distortion is, to a certain degree, formed in the ribs, is increased. When the ribs are thus distorted, the size of the chest is very much diminished, for the middle of

the rib is necessarily brought nearer to the spine."*

The instrument to which I desire to direct attention consists of a frame, and a lever and loop upon it. The frame is formed of a pelvic hoop, of crutches springing from it and rising to the axillæ, and of a connecting dorsal band, which, uniting the crutches, is placed at the superior extremity of the primary curve. This forms a frame which cannot tilt. The crutches are made to lengthen, and the dorsal band is, also, moveable; so that together, or separately, they may be raised, as the curve is opened. Upon the centre of the dorsal band a lever moves on its axis. It is moved by means of a long screw which is attached to the pelvic hoop, and rising to the top of the shoulder, is connected to the shoulder sling or loop. This shoulder sling is formed of a ring of gutta percha; it is accurately moulded to the shoulder, and lies upon the clavicle, the scapula, and the superior ribs beneath the axilla. It is placed on the shoulder which corresponds to the concavity of the primary curve. The convexity of the primary curve is supported by a large pad, which embraces all the

* 'On the Distortions of the Spine,' pp. 65, 120, 1823.

Fig. 2.



ribs that are connected with the vertebral curve. This pad is attached to the lever by a short arm, which may be shortened as the curve is opened. The instrument is figured in Pl. 2.

A, represents the pelvic band.

B, the dorsal connecting band.

C C, the crutches.

A B C C, together forming the frame.

D, the lever.

E, the axis on which it moves.

F, the power by which it is moved.

G, the shoulder loop.

H, the rod connecting the shoulder loop and the lever.

I, the pad to support the convexity.

Thus, the lever being moved, the shoulder sling is raised, not directly upwards, but in the segment of a circle, as figured B C, plate 3. A, representing the axis on which the lever is moved.

Now, it is asserted, that an ordinary straight crutch can effect the same purpose. Fig. 3 is perhaps sufficient to show that a straight crutch rising into the axilla, is equal to unbend only a very slight curve: for rising beyond this, the crutch would no longer rest in the axilla, and the pressure would not only be useless, but intolerable.

Fig. 4 will illustrate better, perhaps, the position which I wish to advance. It is a skeleton drawing from the same subject as that from which fig. 5 was taken.

B D represents the perpendicular line of the body.

C D, the line of deviation.

A D, the line of restoration.

Without the trunk can be carried from C D to A D, and the direction of the shoulders to correspond to E F, the spinal column cannot be redressed.

It is not necessary to assert that the straight crutch is inadequate to this purpose.

Pl. 5 represents the figure of a young person, eighteen years of age, excessively distorted.

Fig. 6 is from a photographic drawing, by Clarkington, of the same person, after the instrument had been worn six months.

For two years pressure had been made on the convexity in this case, by means of the old instrument,—the lateral plate and straight crutch, and distortion had during that time been greatly increased. One instrument was exchanged for the other, and with how much advantage may be determined by comparing figures 5 and 6.

Fig. 7 is, also, from a photograph by Mr.

Clarkington. Distortion, in this instance, has been entirely overcome, although it was almost as great as that represented in fig. 5.

Through the shoulder-sling, pressure is diffused over the superior ribs and the whole shoulder; so that not the axilla alone is subjected to pressure, but the superior portion of the thorax is embraced; and the lever being used to raise the shoulder-sling, the motion imparted is in the segment of a circle, in the reverse direction of the primary curve.

This instrument can be worn effectually during pregnancy, the abdominal belt not being necessary to secure the firm position of the instrument. The weight of this instrument is not more than half that of an ordinary spinal instrument.

In the beginning, a spinal curve resulting from debility and relaxation of ligaments, requires support only for its removal; and, even after long continuance, but before rotation has taken place, support alone is necessary to remove the curve and redress the spinal column. That instrument, consequently, is the best which affords the most support to the bulging ribs and to the sunken shoulder, and which is, at the same time, the least burdensome to the patient.

When rotation of the vertebræ on their axes has been superadded to simple scoliosis, the difficulty of overcoming distortion is much increased; yet, although the treatment required is prolonged, rotation is overcome, when not extreme, in the same ratio as the lateral inclination. This is facilitated by pressure made from behind forwards, on the angles of the ribs. A pad, accurately fitted to the projecting ribs, is acted on by a spring, which rises to it from the pelvic band, and the pressure is regulated by means of a rack and pinion joint. This modified instrument is represented, Pl. 9.

Fig. 8 is an accurate representation of an instance of extreme distortion. It consisted of a severe quadruple curve, with great rotation of the bodies of the vertebræ, projection of the angles of the ribs, and elevation of the scapula, in a delicate girl, eighteen years of age. Distortion had existed five years, and was increasing, when I first saw her. This spinal instrument was worn during twelve months; at the end of which time, the superior compensating curve was entirely removed, and the patient had acquired five inches in height. She had gained health and strength, and was able to walk three and four miles with

ease. Before the spinal instrument was worn, she moved about the house in pain, and rarely walked beyond it. At the expiration of eighteen months the primary curve was much opened, and rotation much reduced.

The only pain complained of by this young person was referred to the inside of the primary curve; and was, doubtless, in great measure dependent on the extension of the ligaments. Fig. 9 is a sketch from a photograph of the same patient, which was taken when the instrument had been worn sixteen months. Although it does not represent accurately the actual distortion, yet comparison with Fig. 8 cannot fail to show a very favorable result.

Although this spinal instrument, or rather the idea of unbending a spinal curve, was suggested by the use of Guérin's chair and Lonsdale's couch, its action differs from these in this respect, that, whereas on the chair and the couch the whole weight of the thorax is borne motionless on the bulging ribs, this instrument offers, instead of pressure, support only. I had long been aware that the only manner of effectually treating a spinal curve is to unbend it; the slightest knowledge of mechanics teaches this; yet I was unable to carry the principle into prac-

tice, until Mr. Evrard's ready art enabled me to do so. Nor was it alone as a mechanist that he showed himself in the construction of this instrument; for it had occurred to him that this mode of treating spinal curvature, was the sole method that could be at the same time effectual and not injurious.

The instrument, which I have now described, may be advantageously worn in every case of lateral curvature of the spine; should the original formation of the bones not forbid, and should anchylosis of the adjacent bodies of the vertebræ not prevent its use.*

The mechanical treatment of lateral curvature, although essentially necessary for the removal of distortion, is, however, only a part of the treatment to be undertaken for the complete restoration of the spinal column. A most important object has, doubtless, been gained, when the column no

* Whilst writing of this spinal instrument, I may be permitted to refer to a letter, which I received during the spring of this year, bearing testimony to its excellence. It was written by a Dane, Ludwig Olsen, himself an excellent mechanist, who had been deputed by the government of his country to visit this and other countries, to report on inventions bearing on medicine and surgery.

Having seen the results produced by this instrument, and having satisfied himself of its power to remove a spinal curve, he wrote to me regarding it as follows:

longer deviates from the vertical; but, that it may be retained erect is equally the province of the surgeon, as its restoration. To restore the straight line of the column, and to leave in operation the causes which produced deviation, is alone worthy of the empiric, when these can be removed by medical aid.

Now, it need scarcely be said that the power of the muscles of the spine is insufficient to retain the column erect, after it has been restored to the perpendicular. There are many adjuvants to assist in their restoration.

General debility, when it has given rise to lateral curvature, requires to be combated with as much, and more, attention, as the curve itself. A support for the weak spine; and generous living, moderate exercise, cold bathing, &c., are,

"It seems to me to be the most effective instrument that I have ever seen; and mainly on this account, that the frame cannot move; whilst all other instruments that I have seen, whether here, in Germany, or in Denmark, cannot be fixed.

"Further, the entire action of this instrument is based on true mechanical principles; and above all, its construction is perfectly simple. Indeed," he adds, "it is very remarkable to observe the effects produced by this instrument. It will probably be much employed and deservedly esteemed."

I refer to this letter rather than to others which I have received, because it was written by an acknowledged judge of these matters.

as every one knows, the means to be adopted for the restoration of health.

Gymnastic exercises are, for the most part, to be avoided until the curve is removed. A single curve is assuredly more easily removed without their aid, and, very frequently, when used for the removal of a single curve, they hasten the formation of a sigmoid curve. It is impossible to bring into action, or effective action, the muscles of one side of the trunk, and leave those of the other side passive; and, consequently, the action of the more powerful muscles is sufficient to counterbalance the good effect of these exercises on the more feeble. Yet exercises may be occasionally used with benefit, when the curve has been nearly removed by mechanical means. But, whenever these are systematically employed, much caution is required both as to the power, and the manner, and the duration of their use.

When the curve has been removed, dumb-bells, swings, and other appliances of a similar kind for the development of the muscles of the back, thorax, and arms, and which tend to improve the general health, are to be recommended. And perhaps no exercise is more beneficial than horse-

exercise; premising always that the hand which corresponds to the weaker side, or that which represented the concavity, be used as the bridle-hand, or that the pommels be changed from side to side, that this hand may be generally used as the bridle-hand.

With regard to hypertrophied muscles, it is obviously necessary to suspend the action of these muscles. This alone, at an early period of curvature of the spine, is half the treatment, and in itself almost sufficient to remove distortion. And, added to this, calisthenic exercises with the hand and arm of the other side, together with well-adjusted support to the convexity of the curve, will generally remove distortion in its earliest stage. At a more advanced stage, pressure applied to the enlarged muscles will materially assist in the reduction of the curve.

Not unfrequently, the muscles on the convexity at the lower horn of a curve of long standing become retracted. These not only assist to perpetuate an obstinate curve, but by their continued retraction increase deformity. It is, occasionally, impossible to overcome these by mechanical means alone; and when they no longer yield to extension, they may be with great ad-

vantage divided subcutaneously. This is an operation very seldom necessary, however, and it should only be undertaken when other and more simple means have failed to reduce the curve.

Spasmodic affections of the muscles of the back are frequently combined with spinal irritation, cerebral and meningeal irritation, and epilepsy. Usually, the pronators of the hand, and the flexors of the fingers, and, also, the extensors of the foot of the same side, are at the same time affected, or they become affected. Disorders of the uterine system are generally observed in these cases; frequently occurring as secondary, and frequently as primary affections.

To restore the functions of whatever organs are primarily disturbed, is the first indication.

Some of these spasmodic affections yield to the salts of zinc and steel. In some I have given, with great advantage, strychnine in very small doses; in others, iodide of potassium. But in these affections of children, I have not found any remedy equal to the local application of a strong solution of iodine in rectified spirit in the course of the spinal column.

Paralysis requires such general treatment as in

these unfortunate cases is indicated, and demands here no special observations. The use of topical stimulants, friction, the acu-puncture, and galvanism, are, singly or combined, frequently availing to restore, at least in some measure, contractility.

Obliquity of the pelvis, when the cause of spinal curvature, must be removed as the spinal curve is removed. In some cases it is very difficult to remove this obliquity. A long-continued recumbent and fixed position may be necessary to effect this purpose. It is usually, however, sufficient to obviate whatever deficiency may exist in the length of the limb by means of a high-soled shoe, or by removal of other deformity in the lower limbs, at the same time that measures are taken to redress the spinal column.

Obliquity of the pelvis necessarily gives rise to a lumbar curve, with its convexity towards the lowest hip. This spinal curve is, at first, a single curve, and the shoulder on the side of the concavity is the lowest shoulder. But, when a compensating curve has been produced, the lowest shoulder and the lowest hip are found on the same side.

Now, it is obvious, that to remove this secondary or compensating curve, is to destroy the means established by nature to restore the equilibrium of the body; whereas, by removing obliquity of the pelvis and the lumbar curve, the compensating curves are simultaneously removed (and even the compensating curves are removed before the primary curve), and the perpendicular line of the column is restored.

Thus, I have endeavoured to show:

1st. That there are many causes of spinal curvature.

2dly. That the position of the primary curve differs as the cause which produced it.

3dly. That to remove mechanically a compensating curve is to increase the primary curve.

4thly. That removal of a compensating curve is effected by acting on the primary curve.

And that, consequently, it is essential to determine which is the primary curve, that through its removal the perpendicular line of the column may be restored.

5thly. That the most effectual mode of removing a spinal curve is by extending its extremities, at the same time that the convexity of the curve is supported.

The end of which is, to determine in each case of spinal curvature:

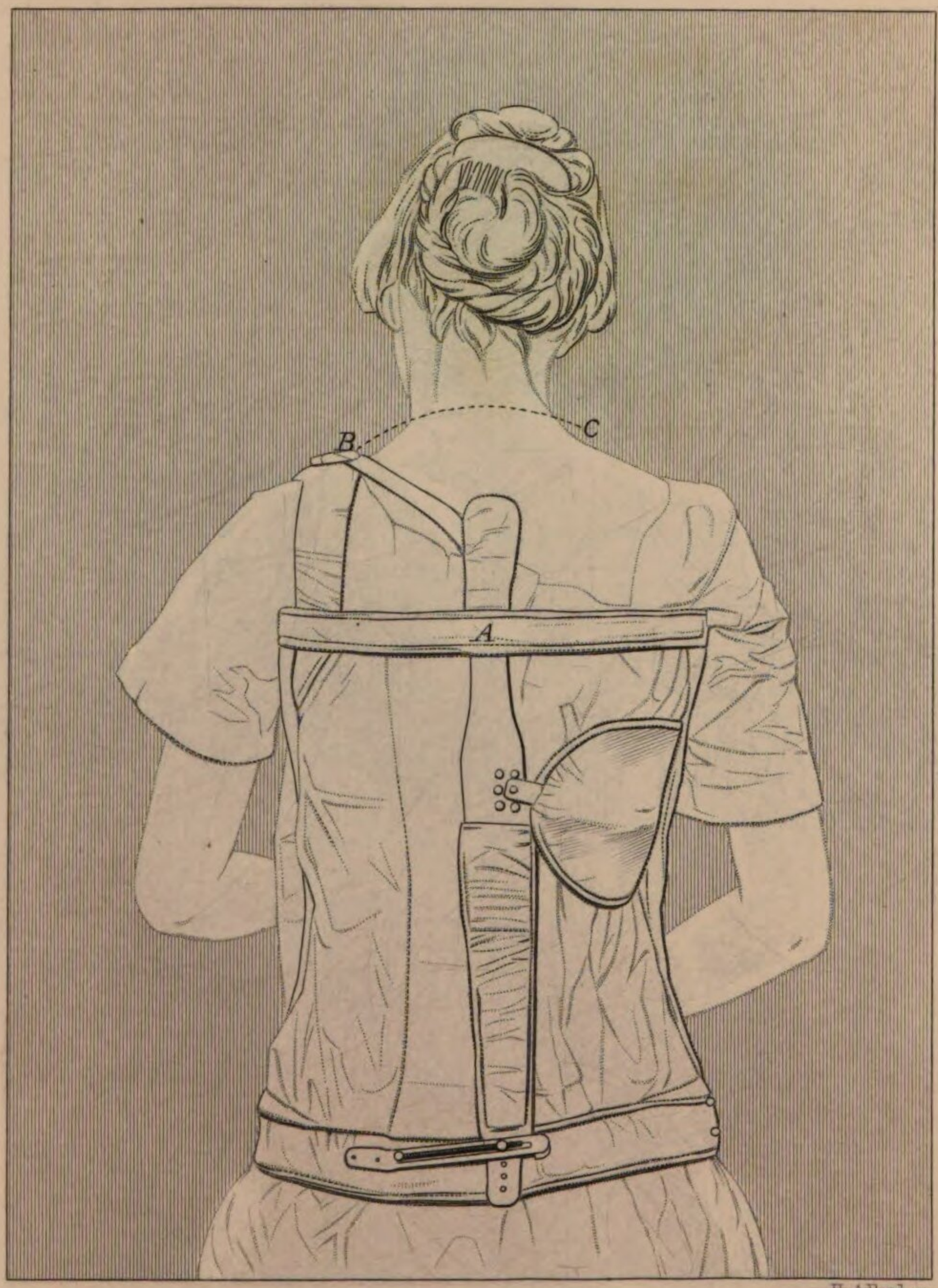
1st. *The cause.*

2dly. Which is the *primary* curve.

3dly. To *unfold the primary curve* by extending the extremities—by raising the superior portion of the curve.

Printed by J. E. Adlard, Bartholomew Close, London.

Fig. 3.



H. Adlard. sc.

Fig. 4.

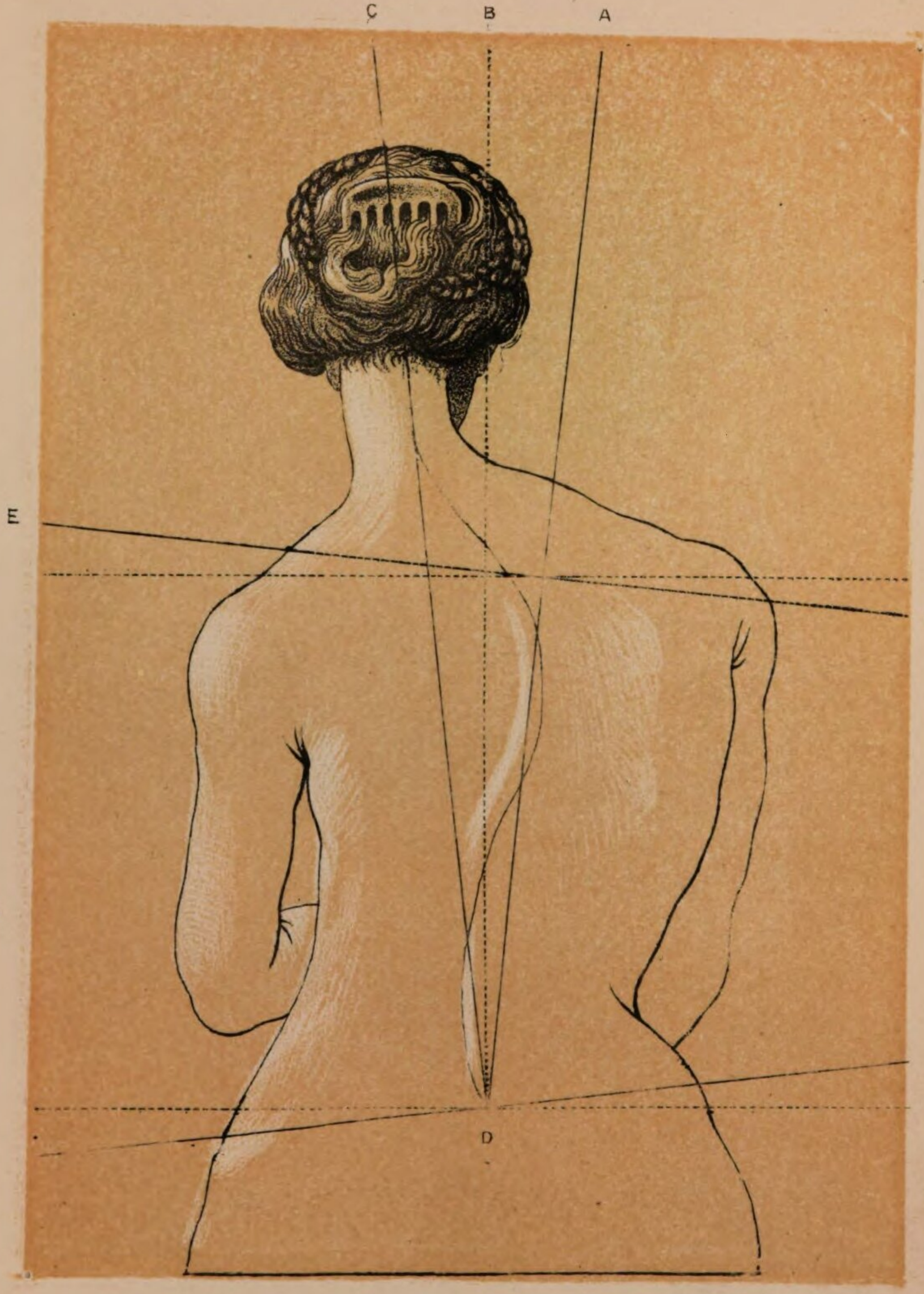
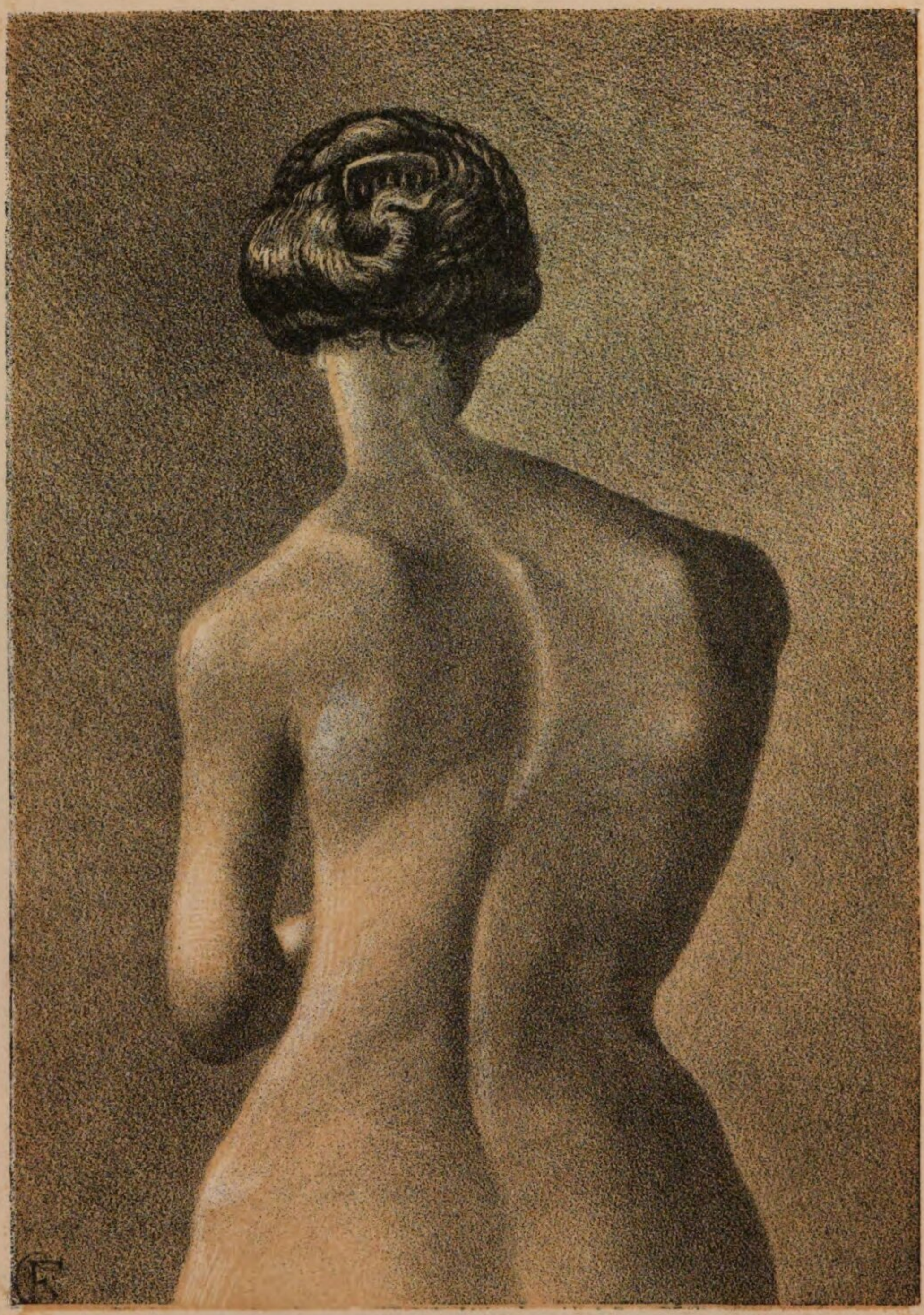


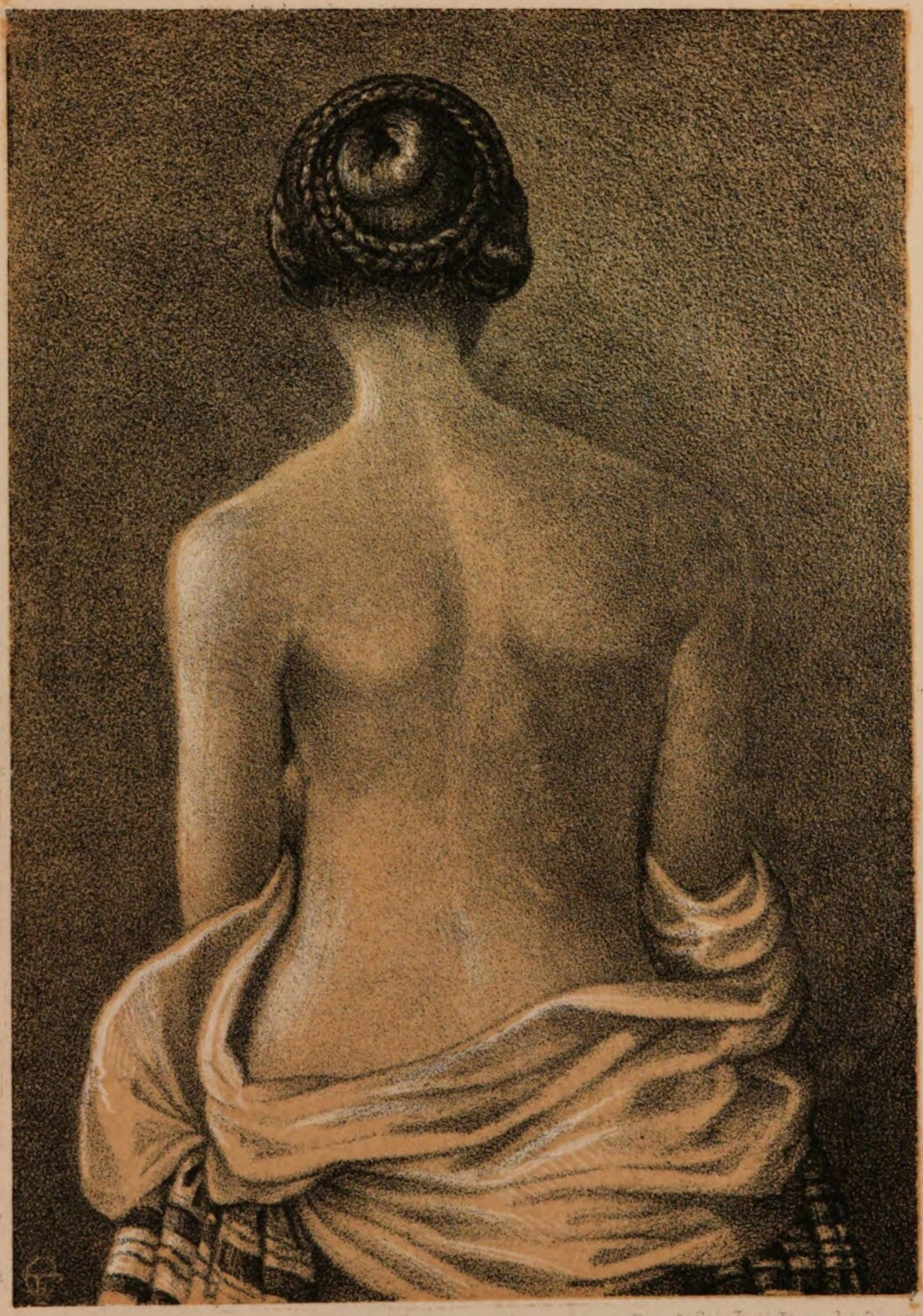
Fig. 5.



Ch. Frank del & Lith.

Day & Son. Lith.rs to the Queen

Fig. 6.



C. Grant del. & Lith.

Day & Son Lith.rs to the Queen

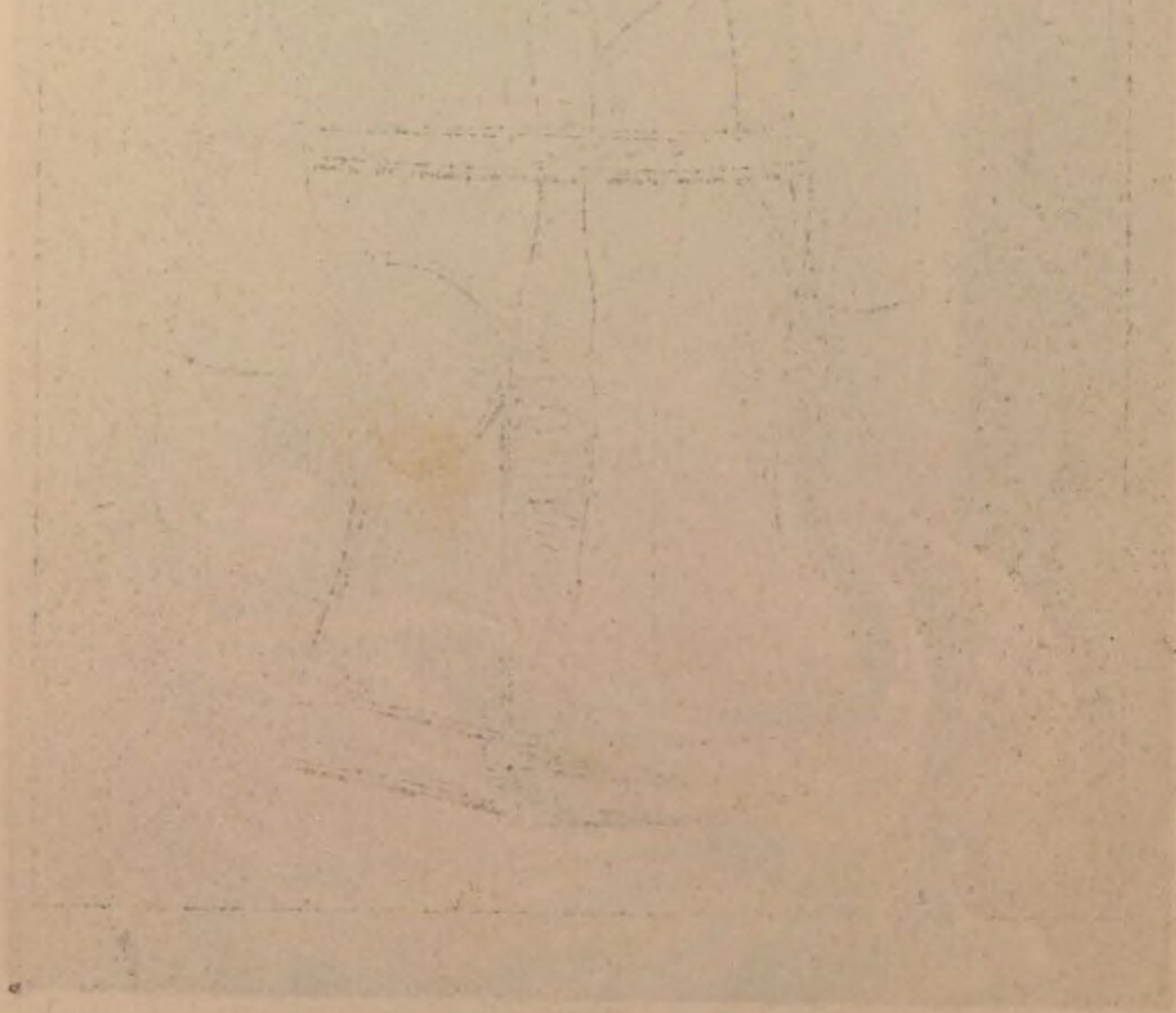
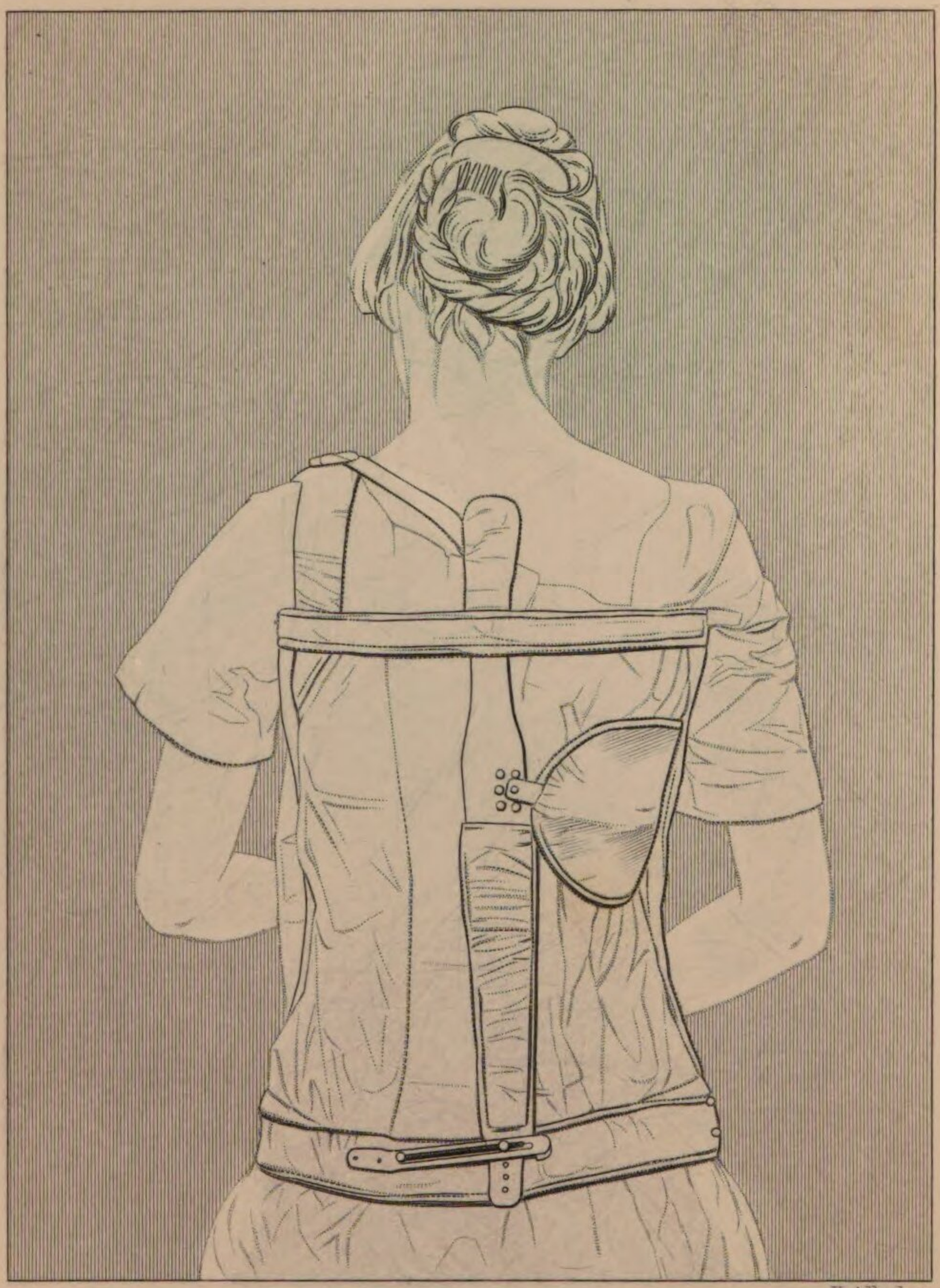
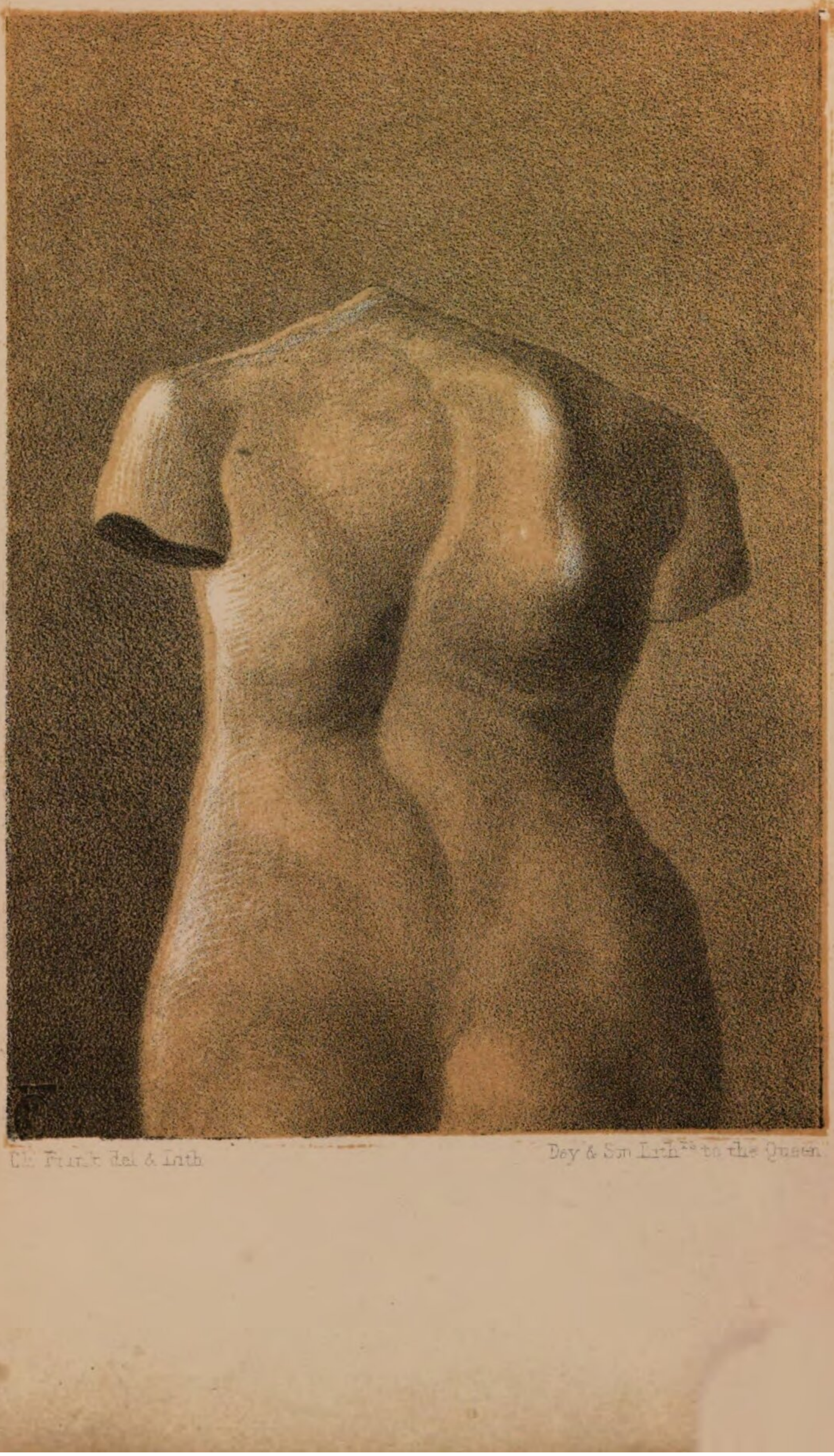


Fig. 7.



H. Adlard, sc.

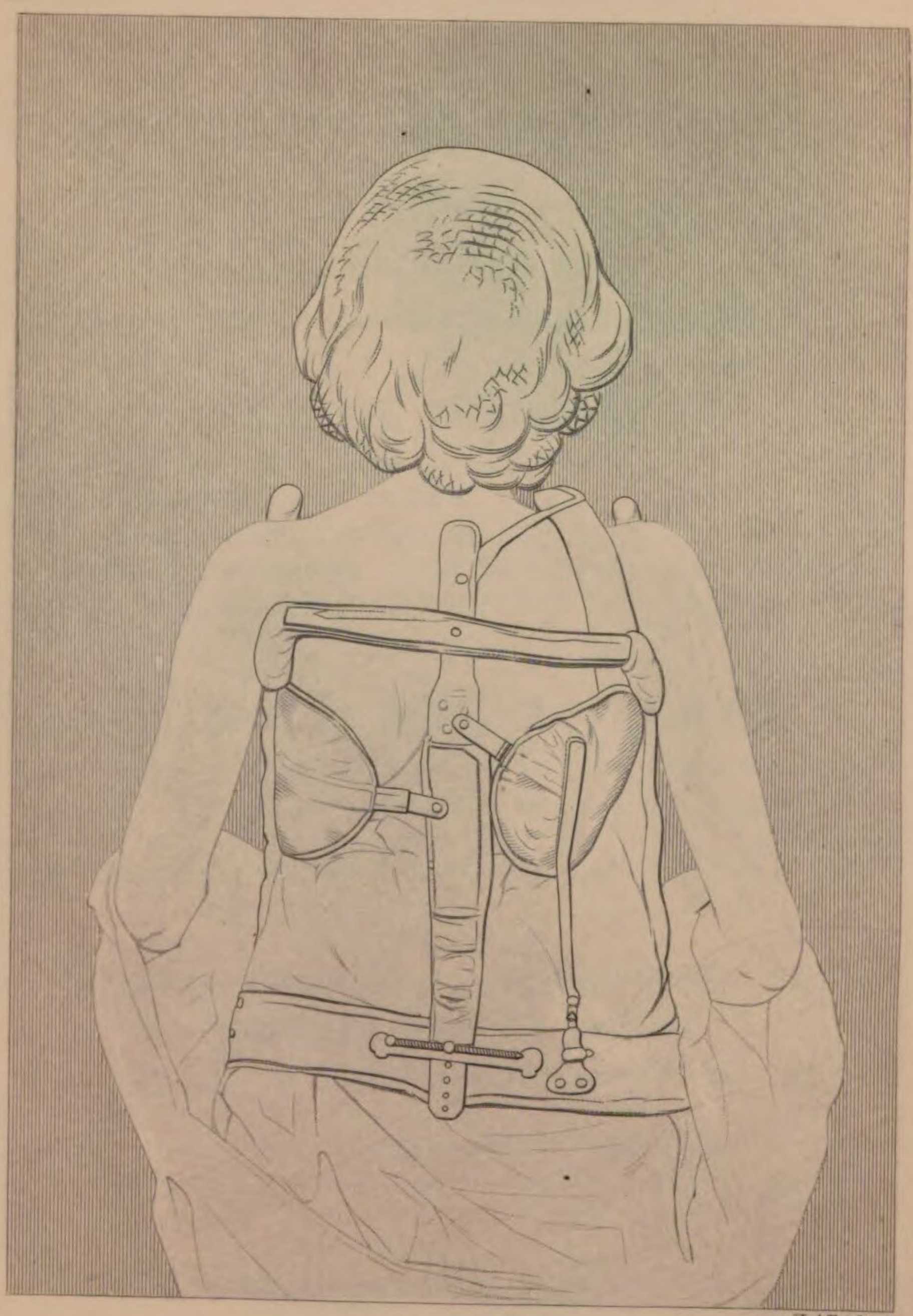
Fig 8.



Ch. Truth del & lith

Day & Son Lith^rs to the Queen

Fig. 9.



H. Adlard, sc.

MR. CHURCHILL'S

Publications,

IN

MEDICINE, SURGERY, AND SCIENCE.

MR. JOHN E. BOWMAN,

Professor of Practical Chemistry in King's College, London.

I.

PRACTICAL CHEMISTRY,

Including Analysis. With numerous Illustrations on Wood. Second Edition. Foolscap 8vo. cloth, 6*s.* 6*d.*

"One of the most complete manuals that has for a long time been given to the chemical student. Every process is indicated with clearness, and the manipulatory details are assisted by an extensive series of woodcuts."—*Athenæum.*

II.

A HAND-BOOK OF MEDICAL CHEMISTRY;

With Illustrations on Wood. Second Edition. Fcap. 8vo, cloth, 6*s.* 6*d.*

"We have examined this treatise, and we can recommend it to the student as a useful elementary guide. The illustrations are numerous and accurate, and well calculated to aid diagnosis."—*Medical Gazette.*

DR. BUDD, F.R.S.,

Professor of Medicine in King's College, London.

ON DISEASES OF THE LIVER.

Illustrated with Coloured Plates and Engravings on Wood. Second Edition. 8vo, cloth, 16*s.*

"In Dr. Budd's work the practitioner will find abundant instructions upon symptoms and treatment. We hope the specimen we have exhibited will induce many to search the work for themselves."—*Lancet.*

DR. CARPENTER, F.R.S.

I.

PRINCIPLES OF HUMAN PHYSIOLOGY.

With numerous Illustrations on Steel and Wood. Fourth Edition. 8vo, cloth, 28*s.*

II.

PRINCIPLES OF COMPARATIVE PHYSIOLOGY.

Illustrated with 300 Engravings on Wood. Fourth Edition. 8vo, cloth, 24*s.*

"It is our opinion that, whether for reference or study in the subject to which it especially refers, no better book than Dr. Carpenter's 'Principles of Physiology, General and Comparative,' can be placed in the hands of student or practitioner."—*Medical Gazette.*

"This is a truly admirable digest of General and Comparative Physiology. We congratulate the professional public and the student on the possession of a book which will enable them to connect their anatomical and physiological knowledge with the whole range of th e natural sciences."—*Edinburgh Monthly Journal.*

"The recent progress of the science of Physiology has been nowhere better marked in the literature of this country than in the works of Dr. Carpenter."—*Athenæum.*

III.

A MANUAL OF PHYSIOLOGY.

With numerous Illustrations on Steel and Wood. Second Edition. Fcap. 8vo, cloth, 12*s.* 6*d.*

"Dr. Carpenter has brought up his Manual, in this new and beautiful edition, to the present state of physiological science. The work is complete. We recommend it as an admirable text-book."—*London Journal of Medicine.*

"We can strongly recommend this volume to the student. This second edition contains the latest additions to physiological science."—*Medical Gazette.*

MR. FOWNES, PH.D., F.R.S.

I.

A MANUAL OF CHEMISTRY;

With numerous Illustrations on Wood. Fifth Edition. Fcap. 8vo,, cloth, 12*s.* 6*d.*

Edited by H. Bence Jones, M.D., F.R.S., and A. W. Hoffmann Ph.D., F.R.S.

"An admirable exposition of the present state of chemical science, simply and clearly written, and displaying a thorough practical knowledge of its details, as well as a profound acquaintance with its principles. The illustrations, and the whole getting-up of the book, merit our highest praise."—*British and Foreign Medical Review.*

II.

THE ACTONIAN PRIZE ESSAY OF 100 GUINEAS,

Awarded by the Committee of the Royal Institution of Great Britain.

CHEMISTRY, AS EXEMPLIFYING THE WISDOM AND BENEFICENCE OF GOD.

Second Edition. Fcap. 8vo, cloth, 4*s.* 6*d.*

MR. GRIFFITHS.

CHEMISTRY OF THE FOUR SEASONS—

Spring, Summer, Autumn, Winter. Illustrated with Engravings on Wood. Second Edition. Foolscap 8vo, cloth, 7*s.* 6*d.*

"This volume combines, in an eminent degree, amusement with instruction. The laws and properties of those wonderful and mysterious agents—heat, light, electricity, galvanism, and magnetism, are appropriately discussed, and their influence on vegetation noticed. We would especially recommend it to youths commencing the study of medicine, both as an incentive to their natural curiosity, and an introduction to several of those branches of science which will necessarily soon occupy their attention."—*British and Foreign Medical Review.*

MR. WHARTON JONES, F.R.S.,

Professor of Ophthalmic Medicine and Surgery in University College.

I.

A MANUAL of THE PRINCIPLES and PRACTICE OF OPHTHALMIC MEDICINE AND SURGERY;

Illustrated with 102 Engravings, plain and coloured. Foolscap 8vo. cloth, 12*s.* 6*d.*

"We can assure students that they cannot meet with a hand-book on this subject that is more ably or more carefully written."—*Medical Gazette.*

"We entertain little doubt that this work will become a manual for daily reference and consultation by the student and general practitioner."—*British and Foreign Medical Review.*

II.

The WISDOM and BENEFICENCE of the ALMIGHTY, as DISPLAYED in the SENSE of VISION;

Being the Actonian Prize Essay for 1851. With Illustrations on Steel and Wood. Foolscap 8vo, cloth, 4*s.* 6*d.*

"A fit sequel to the Bridgewater Treatises: it is philosophically and admirably written."—*Literary Gazette.*

"This treatise resembles in style of treatment the famous Bridgewater Treatises."—*Athenæum.*

DR. BENCE JONES, F.R.S.

ON ANIMAL CHEMISTRY,

In its relation to STOMACH and RENAL DISEASES. 8vo, cloth, 6*s.*

"The work of Dr. Bence Jones is one of the most philosophical and practical which has issued from the press for many years past."—*Lancet.*

"Dr. Bence Jones is already favorably known as the author of works and papers on animal chemistry, and this contribution to his favorite science is calculated to extend his reputation as an able chemist and sound physician."— *Monthly Medical Journal.*

4

DR. ALFRED TAYLOR, F.R.S.,

Lecturer on Medical Jurisprudence and Chemistry at Guy's Hospital.

MANUAL OF MEDICAL JURISPRUDENCE.

Fifth Edition. Fcap. 8vo, cloth, 12*s.* 6*d.*

"We recommend Dr. Taylor's work as the ablest, most comprehensive, and, above all, the most practical useful book which exists on the subject of legal medicine. Any man of sound judgment, who has mastered the contents of Taylor's 'Medical Jurisprudence,' may go into a Court of Law with the most perfect confidence of being able to acquit himself creditably."—*Medico-Chirurgical Review.*

"Dr. Taylor possesses the happy art of expressing himself on a scientific topic in intelligible language. The size of his Manual fits it to be a circuit companion."—*Law Times.*

ERASMUS WILSON, F.R.S.

I.

THE ANATOMIST'S VADE-MECUM; A SYSTEM OF HUMAN ANATOMY.

With numerous Illustrations on Wood. Sixth Edition. Foolscap 8vo, cloth, 12*s.* 6*d.*

"As a satisfactory proof that the praise we bestowed on the first edition of this work was not unmerited, we may observe it has been equally well thought of in foreign countries, having been reprinted in the Uuited States and in Germany. In every respect, this work, as an anatomical guide for the student and the practitioner, merits our warmest and most decided praise."—*Medical Gazette.*

II.

DISEASES OF THE SKIN:

A Practical and Theoretical Treatise on the DIAGNOSIS, PATHOLOGY, and TREATMENT OF CUTANEOUS DISEASES. Third Edition. 8vo, cloth, 12*s.*

THE SAME WORK; illustrated with finely-executed Engravings on Steel, accurately coloured. 8vo, cloth, 30*s.*

"The work is very considerably improved in the present edition. Of the plates it is impossible to speak too highly. The representations of the various forms of cutaneous disease are singularly accurate, and the colouring exceeds almost anything we have met with in point of delicacy and finish."—*British and Foreign Medical Review.*

BAYERISCHE STAATS-BIBLIOTHEK MUENCHEN

516

BSB Bayerische StaatsBibliothek

MDZ Münchener DigitalisierungsZentrum Digitale Bibliothek

Brodhurst, Bernard E.

On lateral Curvature of the Spine, its Pathology and Treatment By Bernard E. Brodhurst

London 1855

Path. 1521 g
urn:nbn:de:bvb:12-bsb10476033-4